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	Datum - Date 11 April 2001

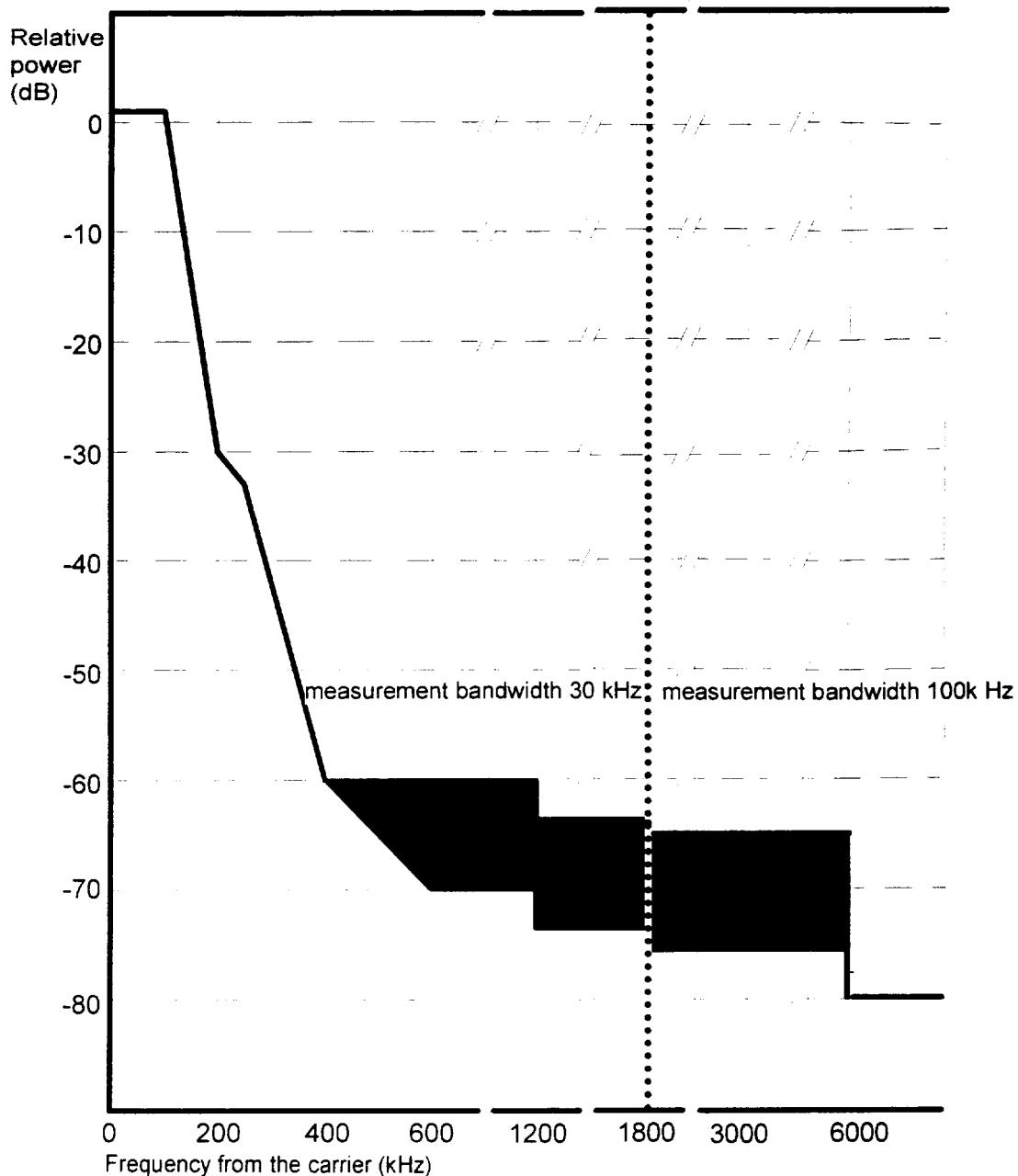
Out of band emissions from BTS without TXBP

Figure 1: GSM 400, GSM 900, GSM 850, MXM 850, DCS 1800, PCS 1900 and MXM 1900 BTS spectrum due to GMSK modulation

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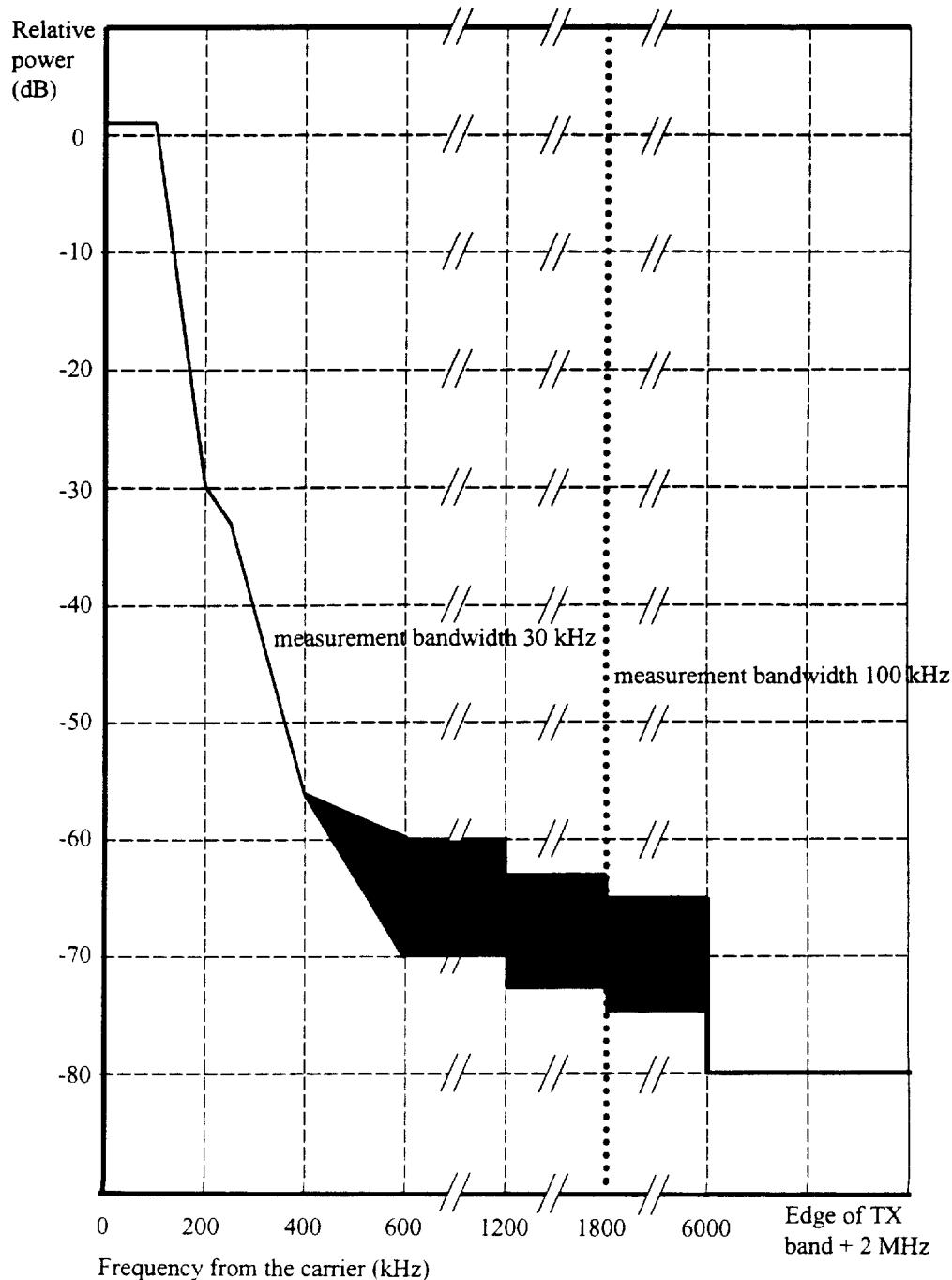
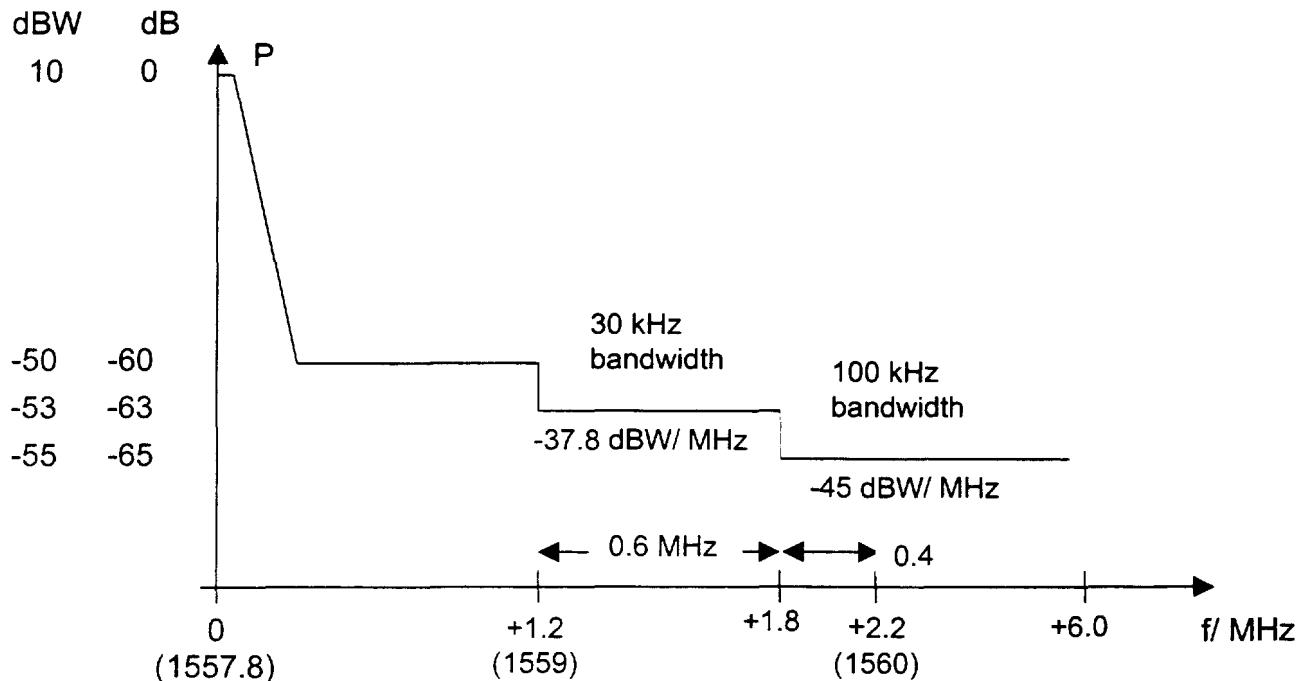


Figure 2: GSM 400, GSM 900, GSM 850, MXM 850, DCS 1800, PCS 1900 and MXM 1900 BTS spectrum due to 8-PSK modulation

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CALCULATION OF THE REQUIREMENT FOR THE TXBP

Req 1: -70 dBW/MHz EIRP from 1559 - 1606 MHz.

Conversion factors:

30 kHz measurement bandwidth $\Rightarrow +15.2 \text{ dB / MHz}$

100 kHz measurement bandwidth $\Rightarrow +10 \text{ dB / MHz}$

Generated emissions:

Average level for 1559 to 1560 MHz $\Rightarrow -40.7 \text{ dBW/ MHz} (0.6 \times 37.8 + 0.4 \times 45)$

Assume 3 dB feeder loss and 16 dBi Antenna gain $\Rightarrow -27.7 \text{ dBW/ MHz} (-40.7 - 3 + 16 = -27.7)$

Filter requirement:

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The filter requirement is therefore to attenuate an average of 42.3 dB over 1 MHz (-70 + 27.7=-42.3)

With the current chip-set for the GSM Transceiver the expected out of band emissions are -63 dB relative power from 1.2 to 1.8 MHz from the center frequency of the carrier, measured in 30kHz bandwidth. -65 dB from 1.8 to 6 MHz measured in 100 kHz bandwidth. This corresponds to an average of -40.7 dBW/MHz for the lowest MHz within the GPS band that is the most at risk.

Req 2: -80 dBW discrete spurious, measured in a 1 kHz bandwidth.

Conversion factors:

30 kHz measurement bandwidth \Rightarrow -15 dB / kHz

Generated emissions

With -53 dBW/ 30 kHz \Rightarrow -68 dBW/ kHz

Assume 3 dB feeder loss and 16 dBi Antenna gain \Rightarrow -55 dBW/ kHz (-68-3+16 = -55)

Filter requirement:

The requirement on the filter is to attenuate 25 dB from 1559 to 1606MHz. (-80+55=-25)

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TXBP WITH SOME ATTENUATION IN 1559 – 1606 MHZ

Below are simulations of TX-bandpassfilter as it could be designed with some attenuation in the GPS-band. The size of the filter is compliant with the GSM-products of today.

In blue are some general specifications in line with other GSM-products of today. In red is a 40dB attenuation reference line for the GPS-frequencies.

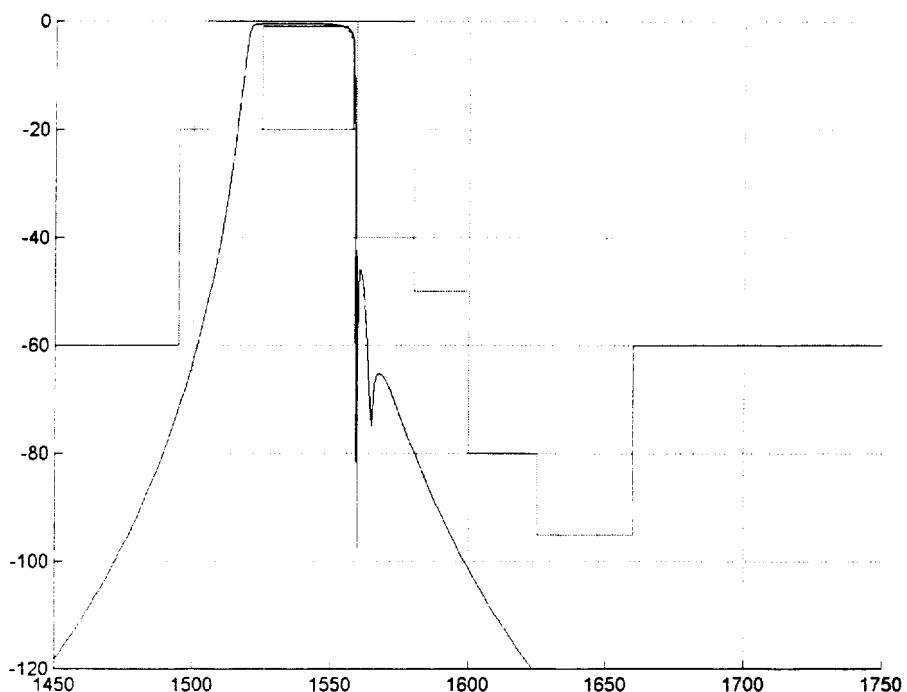
Note that the curves are from a perfect model. That's why there is some margin to suggested specs / performance.

The performance is based on conventional air/metal cavity's with high temperature stability. Performance could be somewhat improved by enforcing a high Q notchfilter for the GPS-attenuation (See section 4.4)

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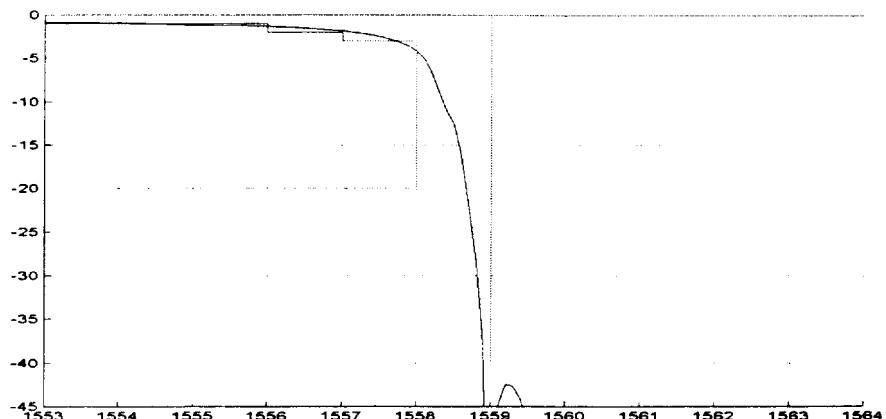
4.1

WIDEBAND PLOT



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4.2 MAGNIFIED PLOT OF GUARDBAND AREA BETWEEN GSM TX AND GPS



4.3 PERFORMANCE OF CONVENTIONAL AIR CAVITY

If about 40 dB attenuation is required approx. performance is as follows:

Passband: 1525 – 1554 MHz	= normal insertion loss
1554 – 1556 MHz	< 0.5 dB increase in insertion loss
1556 – 1557 MHz	< 1 dB increase in insertion loss
1557 – 1558 MHz	< 3.5 dB increase in insertion loss

Guardband: 1558 – 1559 MHz

GPS-band: 1559 – 1606 MHz > 40 dB attenuation

4.4 PERFORMANCE WITH HIGH-Q REJECTFILTER

Passband: 1525 – 1556 MHz	= normal insertion loss
1556 – 1557 MHz	< 0.5 dB increase in insertion loss
1557 – 1557.4 MHz	< 1 dB increase in insertion loss
1557.4 – 1558 MHz	< 2 dB increase in insertion loss

Guardband: 1558 – 1559 MHz

GPS-band: 1559 – 1606 MHz > 40 dB attenuation

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CONCLUSIONS

There will be little difficulties designing a TXBP filter in the current form factor for the GSM BTS that makes the BTS meet the listed requirements for usage with any normally used antennas. Even if a high gain antenna were to be used, filters can be made with an acceptable guardband that make the BTS meet the requirements.